PATENT

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

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| Applicant: | Jess R. Booth et al. | ) Examiner: Peter D. Mulcahy |
| Serial No.: | 10/036,159 | ) Art Unit: 1713 |
| Filed: | December 26, 2001 | ) |
| For: | **SYNTHETIC THERMOPLASTIC COMPOSITION, ARTICLES MADE THEREFROM AND METHOD OF MANUFACTURE** | ) |
| Atty. Dkt. No.: | 7241-101C1/10209911 | ) |

**DECLARATION UNDER 37 CFR § 1.132**

I, Jess R. Booth, declare as follows:

1. I am a joint inventor, with Yorem Aisenberg, of the above-identified patent application.

2. A photograph of a 0.125 inch thick plaque-shaped article made of polymethyl methacrylate and 1 % by weight naturally occurring aluminosilicate glass is attached hereto as Exhibit 1. To demonstrate the transparency of the material, the plaque-shaped article is positioned over a sheet of paper which has the words "0.125 Inch Thick Colorless, Transparent Acrylic Plaque With 1.0 Weight Percent Al-Si Glass" printed thereon.

3. The plaque-shaped article was prepared in the following manner. Aluminosilicate glass powder was preblended in a cool, dry state with polymethyl methacrylate (PMMA) pellets. The aluminosilcate glass contained cristobalite and aluminum oxide. The aluminosilicate glass concentration was 1.0 weight percent of the total of the powder and thermoplastic polymer weight. The preblended material was fed into a 30 mm twin screw for melt compounding of the

PMMA and aluminosilicate glass, extrusion, and cutting into pellets. The plaques were made on an injection molding press from the compounded pellets.

4. The refractive index of aluminosilicate glass was determined in the following manner. A few grains of aluminosilicate glass was mixed with refractive-index oil. The mixture was then viewed in transmitted light on a glass slide under a petrographic microscope, which is a standard method of measuring refractive index. The refractive index of the aluminosilicate glass was determined to be 1.495.

5. I hereby declare that all statements made herein on my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Dated: 1-07-04

Jess R. Booth

0.125 INCH THICK COLORLESS, TRANSPARENT ACRYLIC PLAQUE WITH 1.0 WEIGHT PERCENT AL-SI GLASS

# ENCYCLOPEDIA OF VOLCANOES

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Foreword by
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TABLE I Physical Properties of Useful Volcanic Materials: Color, Typical Grain Size in a Volcanic Occurrence, Density, Strength (Compressive), Thermal Conductivity, Heat Capacity, and Common Uses*

| Volcanic product | Color | Typical grain-size | Density ($g/cm^3$) | Strength (kbar) | Thermal conductivity (kcal/m hr deg) | Common uses |
|---|---|---|---|---|---|---|
| Raw products | | | | | | |
| Basaltic scoria | Black to red | Coarse aggregate < 3 cm | 1.2–2.5 | 0.6–1.6 | <1.0 | Road construction, use in cinder blocks, moderate insulator |
| Basaltic lava | Black/gray | Massive | 2.4–3.1 | <2 | 2.0–3.0 | Construction, decorative purposes, moderate insulator |
| Rhyolite ash | Light gray/brown | Fine aggregate < 2 mm | 1.5–2 | <0.1 | <1.0 | Abrasives, creation of perlite, a good refractory, insulator |
| Pumice | Light gray/brown | Aggregate 0.2–10 cm | 0.5–1.5 | <0.5 | <0.75 | Absorbent, abrasives, good insulator |
| Silicic ignimbrite | Light to dark brown | Massive | 2.1–2.8 | <1 | 2.0–3.0 | Decorative uses, construction, poor to moderate insulator |
| Rhyolite lava | Brown to gray black | Massive | 2.1–2.8 | <25 | 2.0–3.0 | Decorative uses, construction, poor to moderate insulator |
| Obsidian | Clear black | Small lenses or tears (cm) | 2.0–2.5 | <11 | 2.7–3.5 | Decorative uses, cutting implements, poor insulator |
| Native sulfur | Yellow | Microcrystalline | 1.95–2.1 | <0.1 | 0.13 | Chemical additive, component needed to "vulcanize" rubber |
| Bentonite clays | Light brown | <0.005 mm | 1.8–2.6 | <0.1 | Varies widely | Additive to drilling muds, good insulator and sealant |
| Man-made products | | | | | | |
| Perlite | White to light gray | Coarse aggregate < 3 cm | 0.3–1.2 | <0.1 | <1.0 | Absorbent, insulator, lightweight concrete |
| Cinder concrete | Gray | Blocks (man-made) | 2.0 | <0.5 | 3.0–4.5 | Construction, insulation |

* Where appropriate, a range of values has been given. The values given are typical for the materials shown but there can be considerable variance. For example, basaltic scoria has been observed up to meters in size, though these are typically not used for raw materials. The thermal character of the materials is greatly dependent on physical factors, such as vesicularity, or for aggregates their grain size and spatial relationship to one another.

[redacted]

## Nylons

| Type → | | 6/6 Nylon: General Purpose Molding[a] | 6/6 Nylon: Glass Fiber Reinforced[a] | 6/6 Nylon: Glass Fiber, Modified para Dicarboxylic Filled[a] | 6/6 Nylon: General Purpose Extrusion[a] | 6/6 Nylon: High Impact[a] | 6/9 Nylon[a] | 6/12 Nylon | Mineral-filled nylon |
|---|---|---|---|---|---|---|---|---|---|
| PHYSICAL PROPERTIES | ASTM | | | | | | | | |
| Specific Gravity | D792 | 1.13-1.15, — | 1.37, 1.47 | 1.37—1.41 | 1.13, 1.15 | 1.09 | 1.07-1.09 | 1.06-1.08 | 1.47 |
| Ther Cond, Btu/hr/sq ft/°F/in | — | 1.7, — | 1.9, 3.3 | — | 1.7, — | — | 1.5 | 1.5 | — |
| Coef of Ther Exp, $10^5$ per °F | D696 | 4.5, — | 9.1, 1.4 | 1.75 | — | — | 5.0 | 5.0 | 2.7-5.0 |
| Specific Heat, Btu/lb/°F | — | 0.3-0.5 | — | — | 0.3-0.5 | — | 0.3-0.5 | 0.3-0.5 | — |
| Refractive Index, $n_D$ | D542 | Translu | Opaque | Opaque | Opaque | Opaque | Translucent | Translucent | Opaque |
| Water Absorption (24 hr), % | D570 | 1.5, — | 0.5, 0.8 | 0.5-0.7 | 1.5 | — | 0.48 | 0.4 | 0.5-0.9 |
| Coef of Static Frict (against self) | — | 0.04-0.15, — | — | — | — | — | — | — | 0.23 |
| MECHANICAL PROPERTIES | | | | | | | | | |
| Tensile Strength, 1000 psi | D638 | | | | | | | | |
| Ultimate | | 11.9, 11.9 | 25, 30 | 19-22 | 13.8, 8.8 | 7.5, 5.0 | 9.5, 8.5 | 8.5, 8.5 | — |
| Yield | | 11.9, 8.5 | — | — | 12.8, 8.8 | — | — | 8.5, 7.4 | 9-10 |
| Elongation, % | D638 | | | | | | | | |
| Ultimate | | 60, 300 | 1.5, 2.2 | 3 | 90, 240 | 40, 210 | 125, 300 | 150, 340 | 10-25 |
| Yield | | 5, 25 | — | — | 8, 30 | — | 10, 10 | 7, 40 | — |
| Mod of Elast in Tension, $10^5$ psi | D638 | 4.75, 3.85 | 14, 20 | — | — | — | 2.75, 1.5 | — | 5.0 |
| Flex Strength, 1000 psi | D790 | Unbreak. | 28, 35 | 26-28 | — | — | 11, 6 | — | 12-18 |
| Mod of Elast in Flex, $10^5$ psi | D790 | 410, 175 | 10, 16 | 11-13 | 4.1, 1.75 | 2.55, 1.25 | 3.0, 1.5 | 2.9, 1.5 | 3.3-5.0 |
| Imp Str (bars notched), ft-lb/in | D638 | 1.0, 2.0 | 2.5, 3.4[b] | — | 1.3, — | 15, 15-25 | 1.1, 2.0 | 1.0, 1.4 | 1.0-1.5 |
| Compr Strength (1%), 1000 psi | D695 | 4.9, — | 20, 24 | — | 4.9 (1%), — | 1.8 | — | 2.4, — | — |
| Fatigue Str, 1000 psi | D671 | | | | | | | | |
| $10^3$ cyc | | 5.5, 3.4[c] | 6.0, 9.0[b] | — | — | — | — | — | — |
| $10^4$ cyc | | 5.9, 3.2[c] | 6.5, 7.3[b] | — | — | — | — | — | — |
| $10^5$ cyc | | 5.3, 3.1[c] | 6.0, 7.0[b] | — | — | — | — | — | — |
| $10^7$ cyc | | 5.2, 3.1[c] | 5.9, 7.0[b] | — | — | — | — | — | — |
| Hardness (Rockwell) | D785 | R119, R108 | E80, E80 | M85-100 | R118-108 | R112 | R111 | R114, — | R119-121 |
| Abrasion Res (Taber CS-17, 1000g), mg/1000 cycles | D1044 | 3-5, 8-9 | — | — | —, 2-5 | — | — | —, 5.7 | 12-30 |
| ELECTRICAL PROPERTIES | | | | | | | | | |
| Volume Resistivity, ohm-cm | D257 | $10^{14}$-$10^{15}$ | $5.5 \times 10^{14}$, $2.6 \times 10^{14}$ | — | $10^{14}$ | $10^{14}$, $10^{15}$ | $2.3 \times 10^{14}$, $2.6 \times 10^{13}$ | $10^{14}$, $10^{13}$ | $10^{14}$ |
| Dielectric Str (short time), v/mil | D149 | 385 | 400, 480 | 300-400 | — | 380, 330 | 540, 580 | — | 280-480 |
| Dielectric Constant | D150 | | | | | | | | |
| 60 Hz | | 4.0, — | 4.0, 4.4 | — | — | 3.2, 3.5 | 3.9, 5.4 | 4.0, 3.0 | — |
| 1 MHz | | 3.6, — | 3.8, 4.1 | — | — | 3.1, 3.6 | 3.3, 3.4 | 3.5, 4.0 | — |
| Dissipation Factor | D150 | | | | | | | | |
| 60Hz | | 0.014, 0.04 | 0.018, 0.009 | — | — | 0.013 | 0.02, 0.09 | — | — |
| 1 MHz | | 0.04, — | 0.017, 0.016 | — | — | 0.017 | 0.02, 0.02 | 0.02, 0.03 | — |
| Arc Resistance sec | D495 | 120 | 145, 100 | 136 | 120 | 72, 77 | — | — | 115 |
| HEAT RESISTANCE | | | | | | | | | |
| Max Rec Service Temp, F | — | 250-300[a] | 250-300[a] | 250-300[a] | 250-300[a] | — | 225-275[a] | 250 | — |
| Deflection Temp, F | D648 | | | | | | | | |
| 66 psi | | 470 | 507, 500 | — | 470 | 420 | 330 | 230 | 400 |
| 264 psi | | 220 | 495, 500 | — | 220 | 160 | 140 | 180 | 300 |
| CHEMICAL RESISTANCE | | | Inert to most organic chemicals such as esters, ketones, alcohols and hydrocarbons. Resist alkalis and salt solutions, but att by phenols, formic acid, strong mineral acids and strong oxidizing agents | | | | | | |
| APPLICABLE PROCESSING METHODS | | Injection molding | | Extrusion | Injection molding, extrusion | | Injection molding; blow molding, extrusion | | Injection molding |
| USES | | Bearings, gears, bushings, cell forms, brush backs, rod, tubing | Mech parts where lubrication is undesirable or diff | Tubing, rod, pipe, sheeting, laminations | Protective helmets, tool handles and housings | Jacketing for wire and cable, special molded parts | | | Elec housings and mech. parts |

[a] Where two values are given, first is for dry, as-molded material, and second for moisture equilibrium in air; single value pertains to dry material unless otherwise noted. [b] First value for 3000 psi fiber and second for 6000. All values at moisture equilibrium. [c] 3000 psec fiber. [d] Also classified for more heat resistance. [e] ¼ in. [f] Cyclic failure stress at 1800 cycles. [g] Second value is for material conditioned to 50% relative humidity. [h] Values for material moisture conditioned at 50% relative humidity. [i] Zytel ST-801 (DuPont)

| Type and Filler → | |
|---|---|
| PHYSICAL PROPERTIES | |
| Specific Gravity | |
| Ther Cond, Btu/hr/sq ft/°F/in. | |
| Coef of Ther Exp $10^{-5}$ per °F | |
| Spec Ht, Btu/lb/°F | |
| Water Absorption (24 hr), % | |
| MECHANICAL PROPERTIES | |
| Mod of Elast in Tension, $10^5$ | |
| Ten Str, 1000 psi | |
| Elong (in 2 in.), % | |
| Hardness (Rockwell) | |
| Impact Str (bars notched), ft | |
| Mod of Elast in Flex, $10^5$ psi | |
| Flex Str, 1000 psi | |
| Compr Str, 1000 psi | |
| ELECTRICAL PROPERTIES | |
| Vol Res, ohm-cm | |
| Diele Str (short time), v/mil | |
| Diele Const | |
| 60 Hz | |
| 1 MHz | |
| Diele Factor | |
| 60 Hz | |
| 1 MHz | |
| Arc Resistance, sec | |
| APPLICABLE PROCESSING ME | |
| HEAT RESISTANCE | |
| Max Rec Ser Temp, F | |
| Deflection Temp, F | |
| CHEMICAL RESISTANCE | |
| USES | |

| Type 6 Beaulty, lb/ft³ | |
|---|---|
| Ther Cond, Btu/hr/sq ft/°F/in. | |
| Coef of Ther. per °F × $10^{-5}$ | |
| Water Absorption, % vol | |
| Heat Deflection (264 psi), F | |
| Max Rec Service Temp, F | |
| Tensile Str, psi | |
| Ultimate Ten Elong, % | |
| Mod of Elast in Tension, 1000 | |
| Compr Str, psi (10%) | |
| Mod of Elast in Compr, 1000 p | |
| Flex Str, psi | |
| Mod of Elast in Flex, 1000 psi | |
| Shear Str, psi | |
| Mod of Elast in Shear, 1000 ps | |
| Hardness (Rwere D) | |
| Impact Str (bars, unnotched), | |